Study on the Genetics of Human Eye-brows

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ROZPRYM (1934) PUBLISHED a classic work on eye-brows and eye-lashes, based on 524 individuals in the small town of Lissen near Brno. Later, Basu (1941) examined 200 cases among the Bengalis in Calcutta. The hereditary influence was not examined by Basu. Rozprym only casually mentioned the genetic aspect of the problem.

In 1957, I had an opportunity to examine the eye-brow types and whorl-patterns of 83 families in Delhi. The examination covered 501 individuals of different age-groups, and both sexes. No surviving member of a family was left out of the survey so that as complete a picture of the genetic pattern as possible, could be obtained. The families were drawn from the main segments of the Delhi population e.g. the Bengalis, the Tamils, the Telugus, the Sindhis, the Punjabis, and Uttar Pradesh Banias and Kayasthas, though the Bengalis were by far the largest group examined. The Bengali families have been classified separately into (1) Brahmins, (2) Baidyas, (3) Kayasthsa and (4) Others. The first three being distinct, generally endogamous, caste-units while the fourth is a heterogeneous group which includes castes other than the first three. Similarly, the Uttar Pradesh families have been separately classified into the two castes, the Kayasthas and the Banias. No Uttar Pradesh Brahman family was represented in the sample. Table 1 shows the familial distribution of eye-brow and whorl types.

I used the method of examination and system of nomenclature of the eye-brow types and whorls, introduced by Rozprym (1934). Since the symbols used by Rozprym (e.g. a for spreading, b for Even etc) were not easily identifiable with the types they were intended to represent, they have been abandoned for a separate notation such as Sp for the spreading type, E for the Even type of eye-brow etc.

Two eye-brow forms mentioned by Rozprym, namely, (1) the "shedding" type and (2) the "S-shaped" type, call for a little explanation:

(1)"Shedding" type: This does not appear to constitute a distinct type by itself Among the cases studied by Rozprym, this trait was found only among 1 per cent of the sample. They were all over 45 years and, according to Rozprym, most of the hairs in their eyebrows had fallen out, (possibly the reason for the nomenclature). I had five cases which could fall under this category (Table 2A). They were in the age-range 41–50 years and above. Four of these (family 8 Bengali Brahmin, 2 Bengali Baidya, 6 and 7 Bengali Kayastha, Table 1), which were re-checked by me, showed by the contour and the hair-stream of their eye brows, unmistakable resemblance to N, Sp, A and Sp types respectively. The "shedding" type may not, therefore, be a basic type.

(2) "S-shaped". Only one case of this type was found (family 5. Bengali Brahmin, Table 1). Rozprym, too, found only one case of S-type while Basu found none among

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TABLE 1. DISTRIBUTION BY FAMILIES OF EYEBROW AND WHORL-PATTERN[1, 2]

No.	Parents		Children	Total No.	
	Male	Female		Male	Female
BENGALI BRAHMINS					
1	PC′(62)	× SpN′(58)	F SpC′(14), M PC′(20), M SpC′(17), M SpC′(35) (× F SpC′(27), F SpC′(11), M SpC′(7)), F SpC′(33) (× M-M SpE′(11), F SpC′(9), M (SpE′(7), F SpC′(2)), F SpE′(38) (X M-F PN′(23), M SpE′(22), F PN′(15), F SpC′(11)), F NC′(36) (X M SpC′-(40) M SpE′(16), F SpC′(15), F NC′(5)), F NC′(28) (X M PN′-(38) F NC′(7), M EN′(5), F NC′(3))	12	17
2	SpC′(60)	× SpC′(48)	M NE′(28), FNE′(22) (X M SpC′-(27) M SpC′(½), × F NC′(½)) F NC′(19), F NC′(17), F NC′(14), F SpC′(12), M SpC′(8)	5	7
3	PC′(61)	× SpC′(49)	M PC′(30) (X F NE′(21), F NE′(1)), M PE′(20), F PC′(18), M PC′(16)	4	4
4	—	× SpC′(55)	M SpC′(32) (× F SpC′-(24) F SpC′(9), F SpC′(7), M SpE′(6))	2	4
5	SpC′(60)	× SE′(50)	M SpN′(31) (× F NC′(20) − F NN′(2), M SpN′(½)), M SpC′(25), F NC′(22), M SpC′(20), F PC′(17), M PC′(14), M PC′(11)	7	5

[1] Figures with parentheses indicate the respective age of the individuals.

[2] The following abbreviations have been used for the eye-brow types and the whorl-patterns:

1. Eye Brow Types

(i)	Spreading	Sp
(ii)	Arched	A
(iii)	Falling	F
(iv)	Rising	R
(v)	S-Shaped	S
(vi)	Shedding	Sh
(vii)	Peaked	P
(viii)	Narrowing	N
(ix)	Even	E

2. Whorl-Patterns

(i)	Concentric	C′
(ii)	Eccentric	E′

In addition, N′ indicates the absence of a whorl, and stands for Neutral.

M and F prefixed to a pheno-type stands for a male and a female respectively e.g. F SpC′ is a female with Spreading brow-type and Concentric whorl.

TABLE 1.—*Continued*

No.	Parents		Children	Total No.	
	Male	Female		Male	Female
6	SpC′(40)	× SpC′(22)	M SpC′(15), M SpC′(12), M SpC′(9), F SpC′(6)	4	2
7	PC′(41)	× EC′(34)	M EC′(14), M EC′(10)	3	1
8	ShN′(48)	× SpE′(38)	M SpE′(13), F SpE′(7)	2	2
9	SpC′(33)	× SpE′(23)	M SpN′(½)	2	1
10	SpN′(44)	× NC′(36)	M SpN′(12), F NN′(2½)	2	2
11	AC′(53)	× EC′(42)	F EC′(23), M AC′(20)	2	2
12	SpC′(60)	× EC′(50)	F PC′(24), F PC′(20), M SpC′(19), F PC′(15), F SpC′(14), F PC′(10)	2	6
13	SpN′(52)	× FC′(40)	M SpN′(15), F FN′(13), M SpC′(10), M SpE′(8), M FN′(5), F SpC′(3)	5	3
14	FE′(49)	× SpC′(37)	M SpE′(13), M FE′(11)	3	1
15	PE′(54)	× AC′(43)	F PC′(18), F AC′(16), M AC′(14), M PN′(13), M PE′(6)	4	3
16	SPN′(51)	× SpC′(38)	F SpC′(14), M SpC′(12), F SpC′(7)	2	3
17	SpC′(37)	× SpC′(26)	F SpN′(5), F SpC′(4)	1	3
18	SpN′(58)	× PC′(48)	M SpN′(21), F SpN′(18)	2	2
19	PN′(32)	× NC′(27)	M PC′(6), M PN′(2)	3	1
Total				67	69
BENGALI BAIDYAS					
1	SpN′(53)	× NE′(44)	F PC′(24), M NC′(20), M SpE′(12), M NE′(9)	4	2
2	SpC′(57)	× ShC′(47)	M NC′(31) (× F NC′(27)- M NC′(7), M NC′(6)), F EC′(15), F EC′(13)	4	4
3	AC(55)	× NC′(44)	F AC′(24), F NE′(22), F AC′(20)	1	4
4	SpC′(48)	× SpE′(34)	F SpE′(14), M SpC′(12)	2	2
5	AN′(43)	× EC′(31)	M EC′(12), F EC′(6)	2	2

TABLE 1.—*Continued*

No.	Parents		Children	Total No.	
	Male	Female		Male	Female
6	—	× ShC′(54)	F FN′(35) (× M FN′(51)- M EE′(6)), M FC′(21)	3	2
7	PC′(45)	× PN′(36)	M PN′(11), M PC′(9), F PC′(5)	3	2
8	PN′(65)	× PC′(50)	F PC′(28), F PC′(22)	1	3
9	PN′(38)	× SpC′(25)	F SpN′(11), F SpN′(4), F SpN′(2)	1	4
Total				21	25
BENGALI KAYASTHAS					
1	SpC′(64)	× SpC′(56)	M SpC′(36) (× F SpC′(28)- M SpC′(9), M SpC′(6)), F SpE′(30)	4	3
2	—	× NC′(50)	M NC′(36) (× F NC′(30)- M NN′(6), M NN′(3)), M NC′(34), F NC′(16)	4	3
3	SpC′(60)	× SpC′(50)	F SpC′(22), M PN′(20), F SpC′(19)	2	3
4	PC′(56)	× EC′(38)	F EC′(14), M PN′(10)	2	2
5	SpN′(58)	× NC′(48)	F NC′(26) (× M SpN′(37)- F NC′(3))	2	3
6	ShN′(52)	× NE′(39)	F NC′(21), F AE′(16), F NC′(13), M AC′(7), F NE′(3)	2	5
7	—	× ShC′(74)	M SpC′(56) (× F NN′(39)- F PC′(19), M PC′(17), M SpE′(10), M PC′(6), F PC′(1))	4	4
8	FN′(41)	× SpN′(34)	F SpC′(11), M AC′(6), M SpN′(3)	3	2
9	NN′(34)	× SpC′(27)	F SpN′(7), F SpC (5), F NC′(4)	1	4
10	PC′(39)	× SpC′(25)	F PC′(7), F PC′(3)	1	3
Total				25	32
BENGALI (OTHERS)					
1	—	× SpC′(66)	M SpC′(52) (× F PC′(41)- F PC′(25), F SpC′(21), M SpC′(19), F PC′(12) M PC′(9), M SpC′(1)	4	5
2	PC′(30)	× PC′(21)	M PC′(5), F PC′(3), F PC′(1½)	2	3
3	SpE′(43)	× SpC′(33)	F SpC′(18), M PC′(17), M PE′(12), F SpE′(8)	3	3

TABLE 1.—*Continued*

No.	Parents		Children	Total No.	
	Male	Female		Male	Female
4	SpC′(30)	× EC′(23)	F NN′(6), F EC′(4), F EC′(2)	1	4
5	PN′(55)	× SpC′(35)	F SpC′(14), M SpC′(12), M SpC′(10)	3	2
6	PN′(48)	× FN′(35)	M RC′(18), M RC′(13), M PC′(12), M FC′(3)	5	1
7	PC′(41)	× SpN′(31)	F SpN′(9), F SpC′(6), M SpC′(4), M SpC′(2)	3	3
8	SpN′(50)	× —	M SpN′(25)- (× F PE′(30),- F PN′(12), F PN(9), F SpN′(5), F SpC′(3), F SpN(1½)	2	6
Total				23	27
PUNJABIS					
1	SpC′(55)	× EC′(50)	M EC′(34) (× F EC′(24)- F EC′(3½)), M SpC′(30) (× F EC′(26)- M EC′(3)), F EC′(19), M EC′(14)	5	5
2	SpC′(57)	× SpC′(48)	M NN′(33) (× F EC(29)- F NE′(9), M NC(7), F NC(5), M NC(2)) M SpC′(28), F SpC′(14)	5	5
3	PN′(38)	× AE′(36)	F PC′(8), F PE′(5½), M PE′(4½)	2	3
4	NC′(42)	× PC′(33)	M EE′(14), F NC′(11), M NE′(9), F NC′(3½)	3	3
5	AC′(36)	× SpC′(34)	M AC′(15), M AN′(5)	3	1
6	SpN′(36)	× PN′(31)	M PC′(5), M PC′(3), M PC′(2)	4	1
7	PE′(39)	× SpN′(37)	F PN′(16), F PC′(13), F PC′(10), F PC′(6), F PC′(2½)	1	6
8	SpN′(39)	× NC′(32)	M PN′(12), F SpC′(5)	2	2
9	RC′(34)	× NC′(27)	M NC′(10), M NN′(8), M AC′(7)	4	1
10	AN′(29)	× RC′(26)	F RN′(2), F RN′(½)	1	3
11	SpN′(26)	× SpN′(24)	M SpN′(3), M SpN′(1)	3	1
12	PC′(39)	× NC′(30)	F PC′(7), M PC′(1)	2	2
13	PN′(59)	× SpC′(46)	M PC′(25), M PC′(23), F SpC′(19)	3	2

TAALE 1. (*Continued*)

No.	Parents		Children	Total No.	
	Male	Female		Male	Female
14	PC′(41)	× EC′(40)	F PC′(19), M PC′(17), M EC′(15), F PC′(10), F PC′(5), M PN′(1)	4	4
15	PC′(44)	× NN′(38)	F PC′(13), M NN′(11), M NC′(9), M NC′(7), F NC′(5)	4	3
16	PN′(47)	× NC′(36)	M PN′(16), F NC′(15), M PC′(8), M NC′(7)	4	2
17	PC′(58)	× PN′(48)	M PN′(21), M PN′(18), F PC′(17), F PC′(13)	3	3
18	PC′(40)	× SpN′(30)	F PC′(11), M NN′(10), F PC′(6), M PC′(2), M PN′(1)	4	3
19	PN′(56)	× PC′(51)	F PC′(15), F PC′(12), M PC′(10), M PC′(8)	3	3
20	PC′(42)	× SpC′(35)	F PC′(17), F NC′(15), M SpC′(12), M PC′(10), M NC′(8)	4	3
21	SpN′(32)	× RN′(21)	F SpN′(4), M SpN′(2)	2	2
Total				66	58
TELUGU (ANDHRA)					
1	SpC′(47)	× PC′(37)	F SpC′(9), M PC′(7), M SpN′(5)	3	2
Total				3	2
TAMIL (MADRAS)					
1	NE′(41)	× SpE′(31)	M SpC′(12), F SpC′(10), M SpE′(9), M NE′(8), F NC′(6), F SpC′(4)	4	4
2	AC′(32)	× SpC′(32)	M AC′(3), M SpC′(½)	3	1
Total				7	5
SINDHI					
1	SpN′(46)	× PC′(32)	F SpC′(19), M PC′(15), F SpC′(9), M SpC′(4)	3	3
Total				3	3
BANIAS (UTTAR PRADESH)					
1	PN′(33)	× PC′(30)	F PN′(9), F PN′(5)	1	3
2	FN′(47)	× PN′(40)	F PN′(22), M PN′(18), M FN′(14), F PN′(12), F RC′(10), F PN′(7)	3	5

TABLE 1.—*Concluded*

No.	Parents		Children	Total	
	Male	Female		Male	Female
3	NC′(26)	× FN′(22)	F NC′(3)	1	2
4	FN′(32)	× SpN′(25)	M SpC′(7), M SpN′(4), F SpN′(2)	3	2
5	AN′(52)	× NC′(45)	M EC′(23), M PC′(21), M EC′(20), M AC′(19), F NE′(13), M NC′(11)	6	2
Total				14	14
KAYASTHAS (UTTAR PRADESH)					
1	AC′(40)	× SpN′(35)	F SpE′(13), F SpC′(7)	1	3
2	RC′(37)	× SpN′(30)	M SpN′(8), M SpN′(5)	3	1
3	NC′(42)	× PN′(35)	F EN′(11), M PN′(9), F NN′(5)	2	3
4	FN′(47)	× PN′(41)	F PN′(14), F PN′(12), M PN′(10), F PN′(7), F PN′(6), M PE′(2)	3	5
5	PC′(34)	× SpC′(28)	F SpC′(10), M SpC′(8), M PN′(6)	3	2
6	PN′(31)	× SpC′(27)	M SpC′(9), M SpN′(2)	3	1
7	PC′(54)	× AN′(50)	F NN′(19), F PN′(18), M PC′(17), M PC′(15), M AC′(13)	4	3
Total				19	18
Grand total				248	253

TABLE 2. A—DISTRIBUTION OF EYEBROW TYPES BY AGE-GROUPS

Age	Brow Types																		Total
	SP		P		N		E		A		F		R		Sh		S		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.
A. MALES																			
0–10	34	39.6	25	29.1	16	18.6	4	4.6	5	5.8	2	2.3	x	x	x	x	x	x	86
11–20	18	31.6	21	36.8	3	5.2	6	10.4	5	8.8	2	3.6	2	3.6	x	x	x	x	57
21–30	8	44.4	5	27.7	2	11.1	1	5.6	1	5.6	1	5.6	x	x	x	x	x	x	18
31–40	11	32.4	11	32.4	5	14.7	1	2.9	3	8.9	1	2.9	2	5.8	x	x	x	x	34
41–50	7	29.2	8	33.3	3	12.5	x	x	1	4.2	4	16.6	x	x	1	4.2	x	x	24
Over 50	14	48.4	10	34.5	x	x	x	x	3	10.3	1	3.4	x	x	1	3.4	x	x	29
Total	92	37.1	80	32.2	29	11.7	12	4.8	18	7.2	11	4.4	4	1.7	2	0.9	x	x	248
B. FEMALES																			
0–10	29	39.2	22	29.7	18	24.3	2	2.7	x	x	x	x	3	4.1	x	x	x	x	74
11–20	18	28.1	24	37.5	11	17.2	7	10.9	3	4.7	1	1.6	x	x	x	x	x	x	64
21–30	16	34.8	9	19.6	12	26.1	5	10.9	1	2.2	1	2.2	2	4.2	x	x	x	x	46
31–40	18	45.0	7	17.5	7	17.5	3	7.5	2	5.0	3	7.5	x	x	x	x	x	x	40
41–50	5	22.7	5	22.7	5	22.7	4	18.4	1	4.5	x	x	x	x	1	4.5	1	4.5	22
Over 50	4	57.2	1	14.3	x	x	x	x	x	x	x	x	x	x	2	28.5	x	x	7
Total	90	35.5	68	26.9	53	20.9	21	8.3	7	2.9	5	1.9	5	1.9	3	1.3	1	0.4	253

TABLE 2. B—DISTRIBUTION OF WHORL PATTERNS BY AGE

Age	Whorl-Patterns						Total
	C′		E′		N′		
	No.	%	No.	%	No.	%	
A. MALES							
0–10	48	55.8	13	15.1	25	29.1	86
11–20	38	66.6	8	14.2	11	19.2	57
21–30	11	61.1	2	11.1	5	27.8	18
31–40	19	55.9	1	2.9	14	41.2	34
41–50	11	45.8	3	12.5	10	41.7	24
Over 50	16	55.2	1	3.4	12	41.4	29
Total	143	57.6	28	11.3	77	31.1	248
B. FEMALES							
0–10	49	66.2	5	6.7	20	27.1	74
11–20	45	70.3	5	7.8	14	21.9	64
21–30	33	71.7	6	13.1	7	15.2	46
31–40	22	55.0	6	15.0	12	30.0	40
41–50	17	77.2	2	9.2	3	13.6	22
Over 50	6	85.7	x	x	1	14.3	7
Total	172	68.0	24	9.5	57	22.5	253

his subjects. It is not clear whether the S-shaped trait is a distinct type. Among the seven children of family 5 (Bengali Brahmin, Table 1), there were none who inherited the trait.

Rozprym mentioned, besides the two main types of whorls, two exceptional types, the Concrescent and the Approaching, where the glabella is overgrown with hairs. Such exceptional forms did not come to my notice among the subjects examined. The difference in these cases from the principal types of whorls may not be more than one of degree rather than of kind. Several cases were found, corresponding to case 33 of Rozprym, where the concentric whorl was not fully penetrant, and it had developed only on one side of the glabella. Such cases have been marked with an asterisk in Table 1. Variability in expression was a feature among whorls, that could be easily noticed.

Table 2A-B and Table 3 are supplementary to Table 1. Table 2 gives the distribution of brow-types and whorls by age-groups. Table 3 shows the frequency distribution of eye-brow forms and whorl-patterns, separately for each group of the population, and also, the extent of association of a whorl-type with an eye-brow type. Frequencies differ from group to group, and between the sexes. The chi-square difference between the frequencies of brow-types among males and that among females, is 18.82 (df = 8, P between .02 and .01). The corresponding difference for whorls is 5.91 (df = 2, P = .05).

Biswas (1956) measured the degree of association of several pairs of atrributes e.g. the hair colour and the eye-colour, the skin colour and the eye colour of the Santals by means of Karl Pearson's Co-efficient of Mean square Contingency (Udny Yule *et al*, 1940). The co-efficient was calculated for several pairs of whorls and brow-types. They are:

Combination	Males	Females
Spreading-Concentric	.0192(.9 > P > .8)	.0214(.9 > P > .8)
Peaked-Concentric	.0104(P = .90)	.0174(.9 > P > .8)
Narrowing-Concentric	.0024(P = .98)	.0379(P = .70)
Spreading-Eccentric	.0614(.7 > P > .5)	.035(P = .70)
df = 1		

Taking P = .05 as the limit of significance, the deviation from chance expectation was, in none of these cases, significant.

The phenotypes of the parents and the off-spring (Table 4) suggest a genetic influence on the inheritance-pattern of eye-brows. The precise mechanism is, however, not clear. Spreading eye-brow may reasonably be assumed to be the dominant form, since no child has the spreading type of eye-brow without having at least one parent with the trait. An attempt was made to interpret the data on the basis of a multiple allelic series in the order, $A \rightarrow a^0 \rightarrow a^1 \rightarrow a^2 \rightarrow a^3 \rightarrow a^4 \rightarrow a^5 \rightarrow a^6$ (for Sp, S, A, F, P, N, E, and R type respectively). Difficulties however, arose in allocating the several observed types in the allelic series. The status of S-type which appears in one parent and no children, is indeterminate. Further, there are 7A children to 21 non-A children from crosses between Arched and types other than Arched.

Spreading, a result somewhat unexpected from the dominant-recessive relationship assumed. The proportion of F children to non-F children (2 F:16 non-F) arising from crosses between F and types other than Sp and A, is equally disconcerting. Nor is it

TABLE 3. DISTRIBUTION OF WHORL-PATTERNS AMONGST THE DIFFERENT EYE-BROW TYPES

Whorl-patterns	Brow types																		Total (Whorls)
	Sp		P		N		E		A		F		R		Sh		S		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.
A. MALES																			
1. *Bengali Brahmins*																			
C′	22	61.1	9	25.0	x	x	2	5.5	3	8.4	x	x	x	x	x	x	x	x	36
E′	8	57.2	3	21.5	1	7.1	x	x	x	x	2	14.2	x	x	x	x	x	x	14
N′	10	58.8	4	23.5	x	x	1	5.9	x	x	1	5.9	x	x	1	5.9	x	x	17
Total (Eye-brows)	40	59.6	16	23.9	1	1.5	3	4.5	3	4.5	3	4.5	x	x	1	1.5	x	x	67
2. *Bengali Baidyas*																			
C′	3	25.0	2	16.6	4	33.2	1	8.4	1	8.4	1	8.4	x	x	x	x	x	x	12
E′	1	33.4	x	x	1	33.3	1	33.3	x	x	x	x	x	x	x	x	x	x	3
N′	1	16.7	3	49.9	x	x	x	x	1	16.7	1	16.7	x	x	x	x	x	x	6
Total (Eye-brows)	5	23.9	5	23.9	5	23.9	2	9.5	2	9.4	2	9.4	x	x	x	x	x	x	21
3. *Bengali Kayastha*																			
C′	6	42.9	4	28.5	2	14.3	x	x	2	14.3	x	x	x	x	x	x	x	x	14
E′	1	100.0	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1
N′	3	30.0	2	20.0	3	30.0	x	x	x	x	1	10.0	x	x	1	10.0	x	x	10
Total (Eye-brows)	10	40.0	6	24.0	5	20.0	x	x	2	8.0	1	4.0	x	x	1	4.0	x	x	25
4. *Bengali, Others*																			
C′	8	47.0	6	35.3	x	x	x	x	x	x	1	5.9	2	11.8	x	x	x	x	17
E′	1	50.0	1	50.0	x	x	x	x	x	x	x	x	x	x	x	x	x	x	2
N′	2	50.0	2	50.0	x	x	x	x	x	x	x	x	x	x	x	x	x	x	4
Total (Eye-brows)	11	47.8	9	39.2	x	x	x	x	x	x	1	4.3	2	8.7	x	x	x	x	23
5. *Telugu (Andhra)*																			
C′	1	50.0	1	50.0	x	x	x	x	x	x	x	x	x	x	x	x	x	x	2
E′	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
N′	1	100.0	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1
Total (Eye-brows)	2	66.7	1	33.3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	3

6. *U. P. Kayasthas*																			
C′	2	20.0	4	40.0	1	10.0	x	x	2	20.0	x	x	1	10.0	x	x	x	x	10
E′	x	x	1	100.0	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1
N′	3	37.5	4	50.0	x	x	x	x	x	x	1	12.5	x	x	x	x	x	x	8
Total (Eye-brows)	5	26.2	9	47.3	1	5.3	x	x	2	10.6	1	5.3	1	5.3	x	x	x	x	19
7. *U. P. Banias*																			
C′	1	14.3	1	14.3	2	28.5	2	28.6	1	14.3	x	x	x	x	x	x	x	x	7
E′	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
N′	1	14.3	2	28.6	x	x	x	x	1	14.3	3	42.8	x	x	x	x	x	x	7
Total (Eye-brows)	2	14.3	3	21.4	2	14.3	2	14.3	2	14.3	3	21.4	x	x	x	x	x	x	14
8. *Tamil (Madras)*																			
C′	2	50.0	x	x	x	x	x	x	2	50.0									4
E′	1	33.3	x	x	2	66.7													3
N′	x	x	x	x	x	x													x
Total (Eye-brows)	3	42.8	x	x	2	28.6	x	x	2	28.6									7
9. *Sindhi*																			
C′	1	50.0	1	50.0															2
E′	x	x	x	x															x
N′	1	100.0																	1
Total (Eye-brows)	2	66.7	1	33.3															3
10. *Punjabis*																			
C′	5	12.9	18	46.2	8	20.6	4	10.2	3	7.6	x	x	1	2.5	x	x	x	x	39
E′	x	x	2	50.0	1	25.0	1	25.0	x	x	x	x	x	x	x	x	x	x	4
N′	7	30.4	10	43.5	4	17.4	x	x	2	8.7	x	x	x	x	x	x	x	x	23
Total (Eye-brows)	12	18.2	30	45.4	13	19.7	5	7.6	5	7.6	x	x	1	1.5	x	x	x	x	66
SUMMARY																			
C′	51	35.6	46	32.2	17	11.9	9	6.3	14	9.8	2	1.4	4	2.8	x	x	x	x	143
E′	12	42.8	7	25.0	5	17.8	2	7.2	x	x	2	7.2							28
N′	29	37.7	27	35.1	7	9.1	1	1.3	4	5.2	7	9.1	x	x	2	2.5	x	x	77
Total (Eye-brows)	92	37.1	80	32.2	29	11.7	12	4.8	18	7.2	11	4.4	4	1.7	2	0.9	x	x	248

	Concentric		Eccentric		Neutral		Total No.
	No.	%	No.	%	No.	%	
Whorls	143	57.6	28	11.3	77	31.1	248

TABLE 3.—*Continued*

Whorl-patterns	Brow types																		Total (Whorls)
	Sp		P		N		E		A		F		R		Sh		S		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.
B. FEMALES																			
1. *Bengali Brahmins*																			
C′	25	47.2	8	15.1	13	24.5	4	7.6	2	3.8	1	1.8	x	x	x	x	x	x	53
E′	4	50.0	x	x	3	37.5	x	x	x	x	x	x	x	x	x	x	1	12.5	8
N′	3	37.5	2	25.0	2	25.0	x	x	x	x	1	12.5	x	x	x	x	x	x	8
Total (Eye-brows)	32	46.4	10	14.5	18	26.1	4	5.8	2	2.9	2	2.9	x	x	x	x	1	1.4	69
2. *Bengali Baidyas*																			
C′	1	6.2	5	31.3	2	12.5	4	25.0	2	12.5	x	x	x	x	2	12.5	x	x	16
E′	2	50.0	x	x	2	50.0	x	x	x	x	x	x	x	x	x	x	x	x	4
N′	3	60.0	1	20.0	x	x	x	x	x	x	1	20.0	x	x	x	x	x	x	5
Total (Eye-brows)	6	24.0	6	24.0	4	16.0	4	16.0	2	8.0	1	4.0	x	x	2	8.0	x	x	25
3. *Bengali Kayastha*																			
C′	9	36.0	4	16.0	9	36.0	2	8.0	x	x	x	x	x	x	1	4.0	x	x	25
E′	1	25.0	x	x	2	50.0	x	x	1	25.0	x	x	x	x	x	x	x	x	4
N′	2	66.6	x	x	1	33.4	x	x											3
Total (Eye-brows)	12	37.5	4	12.5	12	37.4	2	6.2	1	3.2	x	x	x	x	1	3.2	x	x	32
4. *Bengali, Others*																			
C′	8	47.0	6	35.3	x	x	3	17.7	x	x	x	x	x	x	x	x	x	x	17
E′	1	50.0	1	50.0	x	x	x	x	x	x	x	x	x	x	x	x	x	x	2
N′	4	50.0	2	25.0	1	12.5	x	x	x	x	1	12.5	x	x	x	x	x	x	8
Total (Eye-brows)	13	48.2	9	33.3	1	3.7	3	11.1	x	x	1	3.7	x	x	x	x	x	x	27
5. *Telugu (Andhra)*																			
C′	1	50.0	1	50.0	x	x													2
E′	x	x	x	x	x	x													x
N′	x	x	x	x	x	x													2
Total (Eye-brows)	1	50.0	1	50.0	x	x													2

6. *U. P. Kayasthas*																			
C′	4	100.0	x	x											x	x	x	x	4
E′	1	100.0	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1
N′	2	15.4	7	53.8	2	15.4	1	7.7	1	7.7	x	x	x	x	x	x	x	x	13
Total (Eye-brows)	7	38.9	7	38.9	2	11.1	1	5.5	1	5.6	x	x							18
7. *U. P. Banias*																			
C′	x	x	1	25.0	2	50.0	x	x	x	x	x	x	1	25.0	x	x	x	x	4
E′	x	x	x	x	1	100.0	x	x	x	x	x	x							1
N′	2	22.2	6	66.7	x	x	x	x	x	x	1	11.1	x	x	x	x	x	x	9
Total (Eye-brows)	2	14.3	7	50.0	3	21.4	x	x	x	x	1	7.2	1	7.1	x	x	x	x	14
8. *Tamil (Madras)*																			
C′	3	75.0	x	x	1	25.0	x	x	x	x	x	x	x	x	x	x	x	x	4
E′	1	100.0	x	x	x	x	x	x											1
N′	x	x	x	x															x
Total (Eye-brows)	4	80.0	x	x	1	20.0	x	x											5
9. *Sindhi*																			
C′	2	66.7	1	33.3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	3
E′	x	x	x	x	x	x													x
N′	x	x	x	x	x	x	x	x									x	x	x
Total (Eye-brows)	2	66.7	1	33.3	x	x													3
10. *Punjabis*																			
C′	7	15.9	19	43.2	10	22.7	7	15.9	x	x	x	x	1	2.3	x	x	x	x	44
E′	x	x	1	33.3	1	33.3	x	x	1	33.4	x	x							3
N′	4	36.3	3	27.3	1	9.1	x	x	x	x	x	x	3	27.3	x	x	x	x	11
Total (Eye-brows)	11	18.9	23	39.6	12	20.7	7	12.2	1	1.7	x	x	4	6.9	x	x	x	x	58
SUMMARY																			
C′	60	34.9	45	26.2	37	21.5	20	11.6	4	2.4	1	0.6	2	1.2	3	1.6	x	x	172
E′	10	41.7	2	8.3	9	37.5	x	x	2	8.3	x	x	x	x	x	x	1	4.2	24
N′	20	35.2	21	36.9	7	12.3	1	1.8	1	1.8	4	6.8	3	5.2	x	x	x	x	57
Total (Eye-brows)	90	35.5	68	26.9	53	20.9	21	8.3	7	2.9	5	1.9	5	1.9	3	1.3	1	0.4	253

	Concentric		Eccentric		Neutral		Total
	No.	%	No.	%	No,	%	
Whorls	172	68.0	24	9.5	57	22.5	253

TABLE 4. FREQUENCY OF PHENOTYPES OF CHILDREN FROM PARENTAL CROSSES

Phenotypes of Parents	No. of families	Brow-types: Phenotypes of children								Family size
		SP	S	A	F	P	N	E	R	
Sp × Sp	10	23	—	—	—	—	—	—	—	1, 2, 2, 2, 2, 2, 2, 3, 3, 4
	2	4	—	—	—	3	—	—	—	3, 4
	2	4					6	—	—	3, 7
Sp × S	1	3				3	1			7
Sp × A	1			2						2
	1	2								2
	1	1		1						2
Sp × F	2	5			3					2, 6
	1	3								3
	1	2		1						3
Sp × P	6	14				10	—	—	—	3, 3, 3, 4, 5, 6
	5	14								2, 2, 3, 3, 4
	2	6				3	4	—	—	5, 8
	4					14				2, 3, 4, 5
	1					4	1			5
Sp × N	6	11					7			2, 2, 2, 3, 3, 6
	1	1				1	2			4
	2	2				5				2, 5
	2						2			1, 1
Sp × E	1	1						3	—	4
	1							1		1
	1	2				4				6
	1						1	2		3
Sp × R	2	4								2, 2
Sp × Sh(?)	1	2								2
	1	x					1	2		3
Total	59	104	x	4	3	47	25	8	x	191
A × P	1	—	—	x		3				3
	1			2	—	3				5
	1			1		3	1			5
A × N	1			2			1		—	3
	1			1		1	2	2	—	6
A × E	1							2	—	2
	1			1				1		2
A × R	1								2	2
Total	8			7	x	10	4	5	2	28
F × F	1							1	—	1
F × P	2				2	5			3	4, 6
	1					6				6
F × N	1						1		—	1
Total	5				2	11	1	1	3	18
P × P	6					18			—	2, 2, 3, 3, 4, 4

TABLE 4.—*Continued*

Phenotypes of Parents	No. of families	Brow-types: Phenotypes of children								Family size
		SP	S	A	F	P	N	E	R	
P × N	2					4				2, 2
	2				—	3	6		—	4, 5
	1						1			1
	1					1	1	1	—	3
	2						5	2		3, 4
P × E	2					6	—	2	—	2, 6
	1							2	—	2
Total	17					32	13	7	—	52
N × N	2						4	—	—	2, 2
N × E	1						4			4
N × R	1			1			2			3
Total	4			1			10			11
E × E	1						—	1	—	1
Sh(?) × N	1			2			3			5
Total (a)	95	104	0	14	5	100	56	22	5	306

(a) Includes sub-families

TABLE 5. FREQUENCY OF PHENO-TYPES OF CHILDREN FROM PARENTAL CROSSES

Parents	Whorls: C′ only	E′ only	N′ only	C′ + E′ Total	C′ + N′ Total	E′ + N′ Total	C′ + E′ + N′ Total	Pheno-types of children
C′ × C′								
1	2			1 5	3 10			C′ = 86
2	8		1	4 2 1	6 3			E′ = 9
3	2			1 3	6			N′ = 12
4	2			2				107
5	1			1	1			
6	2				1			
7				1				
C′ × N′								
1	3			1 5	3 9		1	C′ = 73
2	2		6	1	4 3 3		1	E′ = 6
3	3		2	1	4 3		x 1	N′ = 36
4	2			1 1	1 3			115
5				1 3	3		1	
6				1				
7				1				
8				1				
N′ × E′								
1				1	1 1			C′ = 11
2		1		1 3				E′ = 8
3				1 1				N′ = 5
4				1	1 1			24
5				1	2			
N′ × N′								
1		1			2 1	1		C′ = 11
2			2		1 1			E′ = 2
3	1				2			N′ = 17
4	1							30
5					1	1		
6					1			
C′ × E′								
1	x	1	1	1 1	x 1 x	— — —	— 1 1	C′ = 14
2	1	1		1 1 1				E′ = 7
3							1	N′ = 3
4				1				24
5							1	
6					1			
7					1			
E′ × E′								
2				1				C′ = 4
4				1				E′ = 2
6				1				N = 0
								6
Total	82	6	25	50 25 (75)	62 39 (101)	1 5 (6)	5 2 4 (11)	306

possible, on this hypothesis, to account for the A child from the cross, N × R. The attempt was abandoned.

The mode of inheritance of whorls seems to be more complex. Not infrequently, are there E′ and N′ children, beside C′, from C′ × C′ crosses. Similarly there are C′ and E′ children, beside N′, from crosses between N′ and N′ parents (Table 5). The data however, point to a tendency among the children to resemble, phenotypically, their parents more than would be expected on a random basis.

Conclusion: The data for eye-brows and whorls show an inherited tendency among the children, though the mode of inheritance cannot be determined at this time.

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